

SCIENCE

[Entered at the Post-Office of New York, N. Y., as Second-Class Matter.]

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

EIGHTH YEAR.
VOL. XV. No. 382.

NEW YORK, MAY 30, 1890.

SINGLE COPIES, TEN CENTS.
\$3.50 PER YEAR, IN ADVANCE.

THE CHEROKEES IN PRE-COLUMBIAN TIMES.¹

II.

HAVING thus followed back the chain by the light of history and tradition, we turn next to the evidence derived from the mounds.



FIG. 1.

Although it cannot be stated positively that no tribe except the Cherokees occupied this Appalachian region between 1540 and 1690, still the evidence and indications leading to that conclusion are so strong as to justify us in assuming that it is correct. It is possible that clans or small parties from other tribes may have taken up their abode temporarily

One of the ancient burial-places in Caldwell County, N.C., explored by the agents of the United States Bureau of Ethnology, is described as being a burial-pit in the form of a triangle, the two long sides 48 feet each, and the southern base 32 feet, in which the bodies and accompanying articles were deposited and then covered over, but not so as to raise any distinct mound above the natural surface of the ground, or, if so, it had settled to the level of the latter. The depth of the original excavation, the sides of which could be distinctly traced, varied from two and a half to three feet. In this pit were twenty-seven skeletons arranged as follows: nine lying horizontally on their backs on the bottom of the pit, with nothing over them except the dirt (these were buried separately); four were in a sitting posture, and over each a small beehive-shaped vault of cobblestones; four buried two and two in vaults, but lying horizontally at full length; and ten or more in one group, which, from their arrangement in regard to each other, the explorers believed must have been interred at one time, the skeleton of the principal personage of the group resting horizontally on his face on the bottom of the pit. Under the head of this skeleton was a large engraved shell gorget shown in the figure (Fig. 1). Around the neck were a number of large-sized shell beads, probably the remains of a necklace; at the sides of the head, near the ears, five elongate copper beads, or rather small cylinders, varying in length from one and a half to four inches, part of the leather thong on which the smaller ones were strung yet remaining in them. These beads were made of thin copper cut into strips, and then rolled up so as to bring the edges together on one side in a

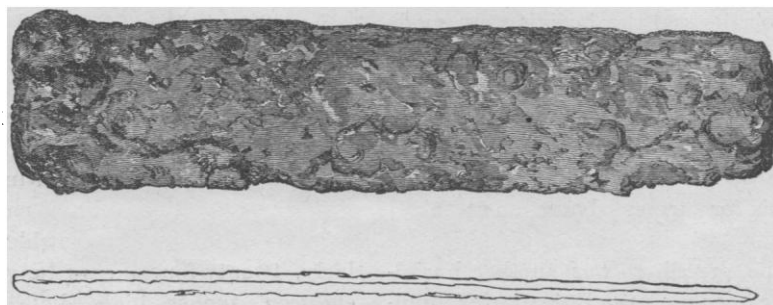


FIG. 2.

with these mountain Indians; but, so far as history informs us and the remains indicate, a single instance of the kind only is known. It is therefore a fair presumption that such mounds or other works of this area, not constructed by the whites, which indicate contact with European civilization, if there be any, are to be attributed to the Cherokees.

¹ Continued from *Science* of May 16, p. 300.

straight line. The plate out of which they were made was as smooth and even as though it had been rolled. Under the breast of the same skeleton was also a piece of copper. The arms were partially extended, the hands resting about a foot from the head. About each wrist were the remains of a bracelet composed of alternate beads of copper and shell. At his right hand were four iron specimens much corroded,

but sufficiently distinct to indicate their form and use. One of these was in the form of a thin celt; another, about five inches long, is apparently part of the blade of a long slender cutting or thrusting implement of some kind, as a sword, dagger, or knife (shown in Fig. 2); another is part of a round awl-shaped implement, a small part of the bone handle in which it was fixed yet remaining attached to it. A careful analysis of the iron of these implements has been made by Professor Clark of the United States Geological Survey, who decides that it is not meteoric. Under the left hand of the same skeleton was another engraved shell, the concave side upward, and filled with shell beads of various sizes.

Around and over the skeleton of this chief personage, with their heads near his, were nine other skeletons. Under the heads of two of these were two engraved shells. Scattered over and between the skeletons of this group were numerous polished celts, discoidal stones, copper arrow-points, plates of mica, lumps of paint, etc.

That these iron articles cannot be attributed to an intrusive burial is evident from the preceding description. They were found at the bottom of the pit, which had been dug before depositing the bodies. With them were engraved shells, polished celts, and other relics of this character, and all were deposited with the principal personage who had been buried in the mound. There were, in fact, no indications whatever of intrusive burials here.

As it is conceded that neither the Indians nor the more civilized tribes of Mexico and Central America were acquainted with the art of manufacturing iron, the presence of these iron articles in the mound indicates contact with the civilization of the Old World. Moreover, a careful examination of the copper cylinders will probably satisfy any one that the plate of which they were made had been rolled or regularly hammered by other than stone implements, and that the strips had been cut into proper shape with some hard metallic instrument. It is reasonable, therefore, to conclude that this burial-pit was dug, and the bodies deposited, subsequent to the discovery of America by Columbus, and in all probability after the date of De Soto's expedition. As the Cherokees alone inhabited this particular section from the time of De Soto's expedition until it was settled by the whites, it is more than probable that the burials were made by them.

This is an important step in the attempt to trace backward the history of this tribe, as it is seemingly the link which crosses the border-line between the historic and prehistoric eras. It should therefore be well sustained by other data before being used as a basis for further advance; but this is not wanting.

On the same farm as the preceding was another burial-place, also explored by the agents of the Bureau of Ethnology, of which an account is given in the "Fifth Annual Report." In this case we have a true mound, although of comparatively little height. This was almost a true circle in outline, thirty-eight feet in diameter, but not more than a foot and a half in height above the natural surface of the ground. Thorough excavation, however, revealed the fact that the builders of the mound had first dug a circular pit of the same diameter, with perpendicular margin, to the depth of three feet, on the bottom of which they deposited their

dead, some in little stone vaults and some without any stone enclosure, and covered them over with earth, raising the mound above the pit.

A plan of the pit, showing the stone vaults and skeletons after the removal of the dirt, is given in Fig. 3. The beehive-shaped vaults were built of water-worn bowlders, with merely sufficient clay to hold them in place.

No. 1 indicates a stone vault standing exactly in the centre of the pit. In this case a small circular hole a little over three feet in diameter, and extending down three feet below the bottom of the pit, had been dug, the body or skeleton placed perpendicularly upon its feet, and a wall built up around it, converging, after a height of four feet was reached, so as to be covered at the top by a single soapstone slab of moderate size. On the top of the head of the skeleton, and immediately under the capstone, were several plates of silver mica, which had evidently been cut with some rude implement. Although the bones were much decayed, yet they were retained in an upright position by the dirt which filled

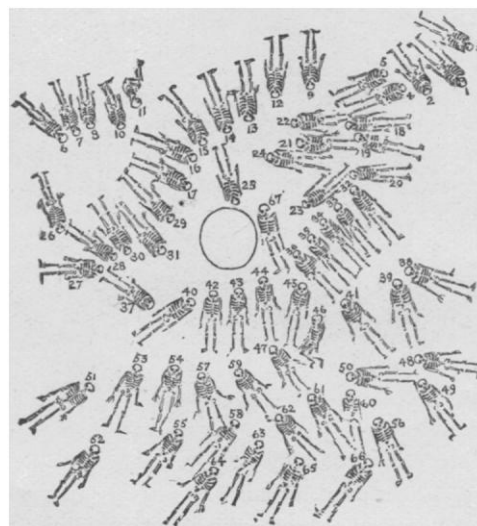


FIG. 3.

the vault,—an indication that the flesh had been removed before burial, and earth packed around the skeleton as the vault was built up.

Nos. 2, 3, 4, 5, 6, 7, 8, 9, and 10 are small vaults, each covering a skeleton placed in a sitting or squatting posture on the bottom of the pit. Nos. 11, 12, and 13 are uncovered skeletons in a squatting posture. Nos. 14 and 15 are uncovered skeletons lying horizontally on the bottom of the pit. No. 16 is an unenclosed squatting skeleton of unusually large size: *A*, a quantity of black paint in lumps; and *B*, a cubical mass of water-worn bowlders built up solidly and regularly, twenty-four inches long, eighteen inches wide, and eighteen inches high, but with no bones, specimens of art, coals, ashes, or indications of fire on or about it. Many of the stones of the little vaults and the earth immediately around them, on the contrary, bore unmistakable evidences of fire; in fact, the heat in some cases had been so intense as to leave its mark on the bones of the enclosed skeletons,—another indication that the flesh had been removed before burial.

The only relic found deserving notice here was a soapstone pipe near the mouth of No. 16.

The proximity of this mound to the Triangle, the occurrence of the pit, and the similarity in the modes of burial, are sufficient to justify us in attributing them to one and the same people. Two hundred yards east of the Triangle was another low mound, covering a circular pit similar to that described. In this were twenty-five skeletons and one stone heap. Some of the skeletons were in a sitting posture, covered with stone vaults, others unenclosed. Some were stretched horizontally on the bottom of the pit, unenclosed. Four of the latter were lying together, with large stones resting on their legs below the knees.

In a different part of the same county, another similar circular burial pit was explored, in which, besides the separate sitting and horizontal skeletons, there was a kind of communal grave similar to that in the Triangle. As there can be no reasonable doubt that all these are the burial-places of one tribe, and there are no indications of intrusive burials, it is legitimate to consider them together, and to draw inferences in regard to the customs of the authors from what is found in either.

Referring to the account given in the "Fifth Annual Report of the Bureau of Ethnology," it is seen that the following articles were found buried with the skeletons of the last-mentioned pit alone: one stone axe; forty-three polished celts; nine vessels of clay, including four pots and two food-cups, the handle of one representing an owl's head, and that of the other an eagle's head; thirty-two arrow-heads; twenty soapstone pipes, mostly uninjured; twelve discoidal stones; ten rubbing-stones; one broken soapstone vessel; six engraved shells, some of the designs on them like that shown in Fig. 4; four shell gorgets; one sea-shell (*Busycon perversum*) entire, and two or three broken ones; five very large copper beads; a lot of shell fragments, some of them engraved; a few rude shell pins made from the *columellæ* of sea-univalves; shell beads and a few small copper beads.

It is evident, from the mode of burial and the articles found, that these works cannot be attributed to white men of post-Columbian times. Can they be attributed to the Indians found inhabiting this region at the time of the advent of the whites? If the evidence justifies this conclusion, we may then attribute them without hesitancy to the Cherokees.

Lawson, who travelled through North Carolina in 1700, states that "the Indians oftentimes make of a certain large sea-shell a sort of gorge, which they wear about their neck in a string, so it hangs on their collar, whereon is sometimes engraven a cross or some odd sort of figure which comes next in their fancy." Beverly, in his "History of Virginia," evidently alluding to the same customs, says, "Of this shell [the conch] they also make round tablets of about four inches in diameter, which they polish as smooth as the other, and sometimes they etch or grave thereon circles, stars, a half-moon, or any other figure suitable to their fancy." Adair states, in his "History of the American Indians," that the priest wears a breastplate made of a white conch-shell, with two holes bored in the middle of it, through which he puts the ends of an otter-skin strap, and fastens a buck-horn white button to the outside of each.

Here, then, is evidence of a custom among the Indians precisely similar to that which prevailed among the mound-builders of the region to which reference has been made.

Nor does the comparison stop with the general resemblance in customs; for among the shells found in the burial-mounds mentioned was one with a cross engraved upon it, and on others were engraved figures that might be readily taken for stars and half-moons (Fig. 4). Moreover, while some are "engraved," others are "smooth," without any devices upon them; and all are pierced with holes for inserting strings by which to hang them about the neck. They are usually made from *Busycon perversum*, which is designated in common parlance a "conch."

That shells of this kind, bearing precisely similar engraved designs, were in use among the veritable mound-builders, is proven by the fact that they have been found in mounds of some of the most important groups of Georgia, Tennessee, and elsewhere. This fact is sufficient of itself to show that the North Carolina burial-places alluded to belong to the mound-building age. If these shell ornaments are the work of Indians, as appears from the statements of the above-named writers, they must have been used by the Cherokees, and buried with their dead.

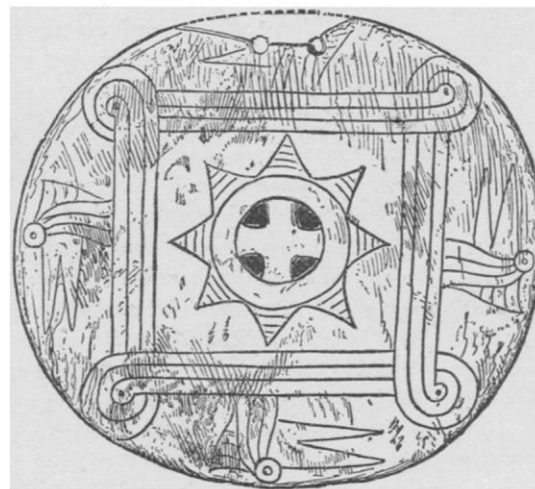


FIG. 4.

The author above quoted says that at the fall of the leaf the Indians gather hickory-nuts, "which they pound with a round stone, upon a stone, thick and hollowed for the purpose." Quite a number of precisely such stones as here mentioned, "thick and hollowed" at the ends, were found in the mounds of Caldwell County, N.C. All who examined them ascribed them without hesitancy to the use mentioned by Adair.

Another fact not mentioned in the preceding description of these mounds and burial-places is that in one,—the circular pit,—mixed with those having heads of the ordinary form, were some eight or ten skeletons with heads of elongate form, due to artificial pressure.

This furnishes strong evidence that the people who buried here were Indians. It is true, it was not a custom of the Cherokees to compress the head, but it was of their neighbors and hereditary foes, the Catawbas. As this is the only instance of skulls of that form being found in the mounds of this section, it is possible they were captives from that tribe; but why buried here, unless they had been adopted by the Cherokees, is a question difficult to answer.

In the mounds and burial-places mentioned were also found a large number of nicely carved soapstone pipes, usually

with the stem made in connection with the bowl, though some of them are without this addition, consisting only of the bowl, with a hole for the insertion of a cane or wooden stem.

By turning to Adair's "History of the American Indians," we find this statement: "They [the Indians] make beautiful stone pipes, and the Cherokees the best of any of the Indians, for their mountainous country contains many different sorts and colors of soils proper for such uses. They easily form them with their tomahawks, and afterwards fin-

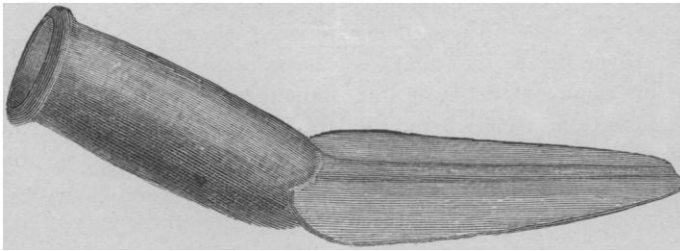


FIG. 5.

ish them in any desired form with their knives; the pipes being of a very soft quality till they are smoked with, and used with the fire, when they become quite hard. They are often a full span long, and the bowls are about half as long again as those of our English pipes. The fore-part of each commonly runs out with a sharp peak two or three fingers broad and a quarter of an inch thick."

Not only were pipes made of soapstone found with the stem carved in connection with them, as indicated in the above quotation, but two or three were obtained of precisely the form mentioned by Adair, with the fore-part running out in front of the bowl; and others of the same form have been found in West Virginia, Ohio, and elsewhere. Some of the forms, including one from a mound in Sullivan County, East Tenn., are shown in Figs. 5 and 6. As will be seen, one of these, of which numerous examples were found, has a very modern appearance,—a form which was first adopted in England in the time of Queen Elizabeth. It may be remarked, in passing, that the mound in Sullivan County, Tenn. (shown in Fig. 37, "Fifth Annual Report of the Bureau of Ethnology"), belongs to the same type as that of Caldwell County, N.C. Here, however, instead of a pit, a circular wall some three or four feet high is built on the natural surface of the ground, and the bodies or skeletons are seated in regular order on this natural surface, after charcoal and ashes have been strewn over it, and over each a little vault built.

Haywood, in his "Natural and Aboriginal History of Tennessee," says, "Mr. Brown, a Scotchman, came into the Cherokee nation in the year 1761, and settled on the Hiawasee River or near it. He saw on the Hiawasee and Tennessee the remains of old forts, about which were axes, guns, hoes, and other metallic utensils. The Indians at that time told him that the French had formerly been there and built these forts."

During the year 1883 one of the assistants of the Bureau of Ethnology explored this particular section which Haywood refers to. An overflow and a change in the channel of the river brought to light the remains of old habitations and numerous relics of the people who formerly dwelt there.

Moreover, this was in the precise locality where tradition and the statement of the Cherokees located a Cherokee town. Digging was resorted to in order to complete the exposure which the water had begun. The only object in view in referring to this exploration is to note some of the articles found: ten discoidal stones precisely like those from the mounds of Caldwell County, N.C.; nine strings of glass beads; a number of shell beads exactly like those from the mounds; a number of flint arrow-points; one soapstone pipe; some pieces of smooth sheet copper; three conical copper ear pendants precisely of the pattern of some found in one of the Carolina mounds; three buttons of modern type; one small brass gouge; fragments of iron articles belonging to a bridle; one bronze sleigh-bell; one stone awl or drill; fragments of a soapstone pot; one soapstone gorget; several polished stone celts similar to those found in the Carolina mounds; grooved stone axes; a piece of sheet lead.

This admixture of articles of civilized and savage life confirms the statement made by Haywood, at least so far as regards the early presence of white people in this section. It follows, from what has been presented, that the Indians living here after the appearance of the whites must have been Cherokees; and the fact that the implements and ornaments of aboriginal manufacture found here are throughout precisely like those obtained from the mounds mentioned, affords a very strong proof that the latter are to be attributed to the same people.

Additional and perhaps stronger evidence, if stronger is needed, that the people of this tribe were the authors of most of the ancient works in western North Carolina and East Tennessee, is to be found in certain discoveries made by the Bureau assistants in Monroe County, Tenn.

A careful exploration of the valley of the Little Tennessee River from the point where it leaves the mountain to its confluence with the Holston was made, and the various mound groups located and carefully surveyed.

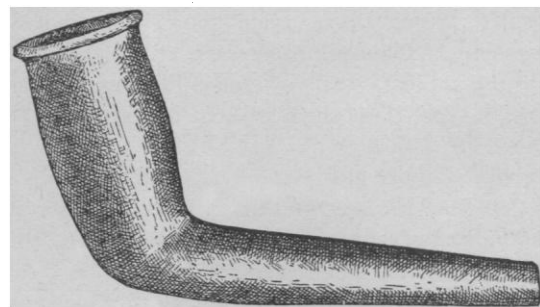


FIG. 6.

Here, on the exact sites of the "Over-hill towns," as shown by Henry Timberlake's map of 1765, using the map of the same region by the Geological Survey as a means of comparison, were found mound groups; not in a general sense only, but in the order given and at the points indicated, a group for each town, and in the only spots the valley, for this distance, affords. Commencing with the large island immediately below the mouth of Tellico River at the west end of Timberlake's map, we see the town of Mialoqua, partly on the island, and partly on the south bank. Referring to the Bureau map, which will appear in the general report of mound explorations, we see that the mounds are also

partly on the island, and partly on the south bank. On the latter map, group No. 2 corresponds with "Toskegee" of Timberlake's map; No. 3, with "Tommotley;" No. 4, with "Toqua;" No. 5, with "Tennessee;" No. 6, with "Chote;" No. 7, with "Settahoo;" No. 8, with "Half-way Town;" No. 9, with "Chilhowey;" and No. 10, with "Tellassee." Such remarkable coincidence cannot be attributed to mere chance. There is also the additional fact that the evidences of village sites which must have been left by the Cherokee towns were found only about the groups, though careful search was made by the Bureau agents along the valley.

As these mounds, when explored, yielded precisely the kind of ornaments and implements used by the Cherokees, it is reasonable to believe they built them.

Ramsey also gives a map of the Cherokee towns in his "Annals of Tennessee;" but his list, although corresponding, so far as it goes, with the order given by Timberlake, evidently refers to a date corresponding with the close of their occupancy of this section. Bartram gives a more complete list. This includes some towns on the Holston (his "Cherokee") River and some on the Tellico Plains, the localities corresponding with mound groups discovered by the Bureau agents. For example: some three or four groups are in the region of the Tellico Plains, and five or six on the Little Tennessee below Fort Loudon, and on the Holston near the junction of the two. One large mound and a group were discovered on the "Big Island" mentioned by Bartram, on which he locates a town, but fails to give the name.

The largest of these groups is situated on the Little Tennessee above Fort Loudon, and corresponds with the position of the ancient "Beloved town of Chota" ("Great Chote" of Bartram) as located by tradition and Timberlake's map. According to Ramsey, at the time the pioneers, following in the wake of Daniel Boone near the close of the eighteenth century, were pouring over the mountains into the valley of the Watauga, a Mrs. Bean, who was captured by the Cherokees near Watauga, was brought to their town at this place, bound, and taken to the "top of a mound" to be burned, when Nancy Ward, then exercising in the nation the functions of the "beloved" or "pretty woman," interfered, and pronounced her pardon. Ramsey does not give his authority for this statement, but, in all probability, obtained the information from the descendants of Mrs. Bean, who, as the writer knows, were residing in Hawkins County as late as 1850, and probably at the present time. "Nancy Ward" probably received her English name from some white family that resided for a time in that section.

During the explorations of the mounds of this region by the Bureau agents, a peculiar type of clay beds was found in several of the larger tumuli. These were always saucer-shaped, varying in diameter from six to fifteen feet and in thickness from four to twelve inches. In nearly every instance there was a series one above another, with a layer of coals and ashes between. A series usually consisted of from three to five beds, sometimes only two, decreasing in diameter from the lowest one upwards. These apparently marked the stages of the growth of the mound, the upper one always being near the present surface.

The large mound on the supposed site of Chota, and possibly the one on which Mrs. Bean was about to be burned, was thoroughly explored, and found to contain a series of

these clay beds, which always show the action of fire. In the centre of some of these were found the charred remains of a stake, and about them the usual layer of coals and ashes; but in this instance immediately around where the stake stood were the charred fragments of human bones. There may be no connection between this fact and Ramsey's statement, yet the coincidence is suggestive.

The burials in this mound, which was a large one some twelve feet high, were at various depths, from two and a half to nine feet, and, although the series of clay beds indicated growth, there was nothing to indicate separate and distinct periods, or to lead to the belief that any of these were intrusive. On the contrary, the evidence is pretty clear that all these burials were by one tribe or people. It is believed that no satisfactory evidence of intrusive burials has been discovered in this entire Appalachian region. By the side of nearly every skeleton in this mound were one or more articles, as shell masks, engraved shells similar to those heretofore mentioned, shell pins, shell beads, perforated shells, discoidal stones, polished celts, arrow-heads, spear-heads, stone gorgets, bone implements, clay vessels, and copper hawk-bells. The last-named articles were with the skeleton of a child found at the depth of three feet and a half. They are precisely of the form of the ordinary sleigh-bell of the present day, but with pebbles and shell beads for rattles.

That this child belonged to the people by whom the other burials, some of which were at less depth, were made, there is no reason to doubt; and that the bells indicate contact with Europeans must be conceded.

In another mound a little farther up the river, one of a group marking the site of one of the "Over-hill towns," were discovered two carved stone pipes of a comparatively modern Cherokee type.

During the fall of 1888, a farmer of East Tennessee, while examining a cave with a view of storing potatoes in it during the winter, unearthed a well-preserved human skeleton, which was wrapped in a large piece of cane matting. This, which measures about six by four feet, is quite pliant, and, with the exception of a rent in the corner, perfectly sound. It has a broad, submarginal stripe of red running around it. Enclosed with the skeleton was a piece of cloth made of flax, about fourteen by twenty inches, almost uninjured, pliant, but apparently unfinished. The stitch in which it is woven is precisely the same as that imprinted on pottery shown in a cut in Mr. Holmes's paper on "Mound-Builders' Textile Fabrics" ("Fifth Annual Report of the Bureau of Ethnology"). Although the earth in the cave contains salts which would aid in preserving any thing buried in it, these articles cannot be assigned to any very ancient date, especially as there were with them the remains of a dog from which the skin had not all rotted away. These were in all probability placed here by the Cherokees of modern times, and form a link between the historic and prehistoric times not easily broken.

Another important find was made in this locality by one of the Bureau agents in 1889. This is a small stone on which some characters have been rudely etched, and is shown in the figure on p. 328. An examination by those familiar with the subject will probably soon satisfy them that some of the characters, if not all, are letters of the

Cherokee alphabet. As the presence of the stone in the mound cannot be attributed to an intrusive burial, it is evident that the mound must have been built since 1820, that Mr. Guess was not the author of the Cherokee alphabet, or that the stone is a fraud. The mound in which this was found is described as follows:—

"The Tipton group is situated on the north side of the Little Tennessee, about two miles from Morganton. No. 3 of this group, which stands about one hundred feet from No. 2, is of small size, measuring twenty-eight feet in diameter and about five feet in height. Some large trees," says Mr. Emmert, the Bureau agent, "were standing on the mound, and Mr. Tipton informed me that he had cut other trees off of it forty years ago, and that it had been a cluster of trees and grape-vines as far back as the oldest settler could recollect. There was an old stump yet in the centre, the roots of which ran down in the mound almost or quite to where the skeletons were found. . . . Having worked to the bottom, I found here nine skeletons lying at full length on the natural surface, with faces up, and surrounded by dark-colored earth. No. 1 (as shown in the diagram which accompanies his report) was lying with head to the south;



FIG. 7.

while No. 2, close by the side of it, had the head to the north, and feet almost touching the head of the other. On the same level, but apart from the preceding, were seven other skeletons lying closely side by side, heads all to the north, and all in a line. No relics of any kind were found with any of the skeletons except No. 1. Immediately under the skull and jaw-bones were two copper bracelets, an engraved stone (Fig. 7), a small drilled stone, a single copper bead, a bone instrument, and some small pieces of polished wood. The earth about the skeletons was wet, and the pieces of wood were soft and colored green by contact with the copper bracelets. These bracelets had been rolled up in something which crumbled off when they were taken out, but whether buckskin or bark I was unable to decide. The engraved stone was lying partially under the skull. I punched it with my steel prod on the rough side in probing, before I reached the skeletons."

As soon as the collections made by Mr. Emmert during this exploration were received at the office in Washington, a member of the Bureau was sent to the field where Mr. Emmert was at work, to learn the whole history of the find. This course was taken by the Bureau merely as a means of being fortified with all possible evidence as to the facts of the find being as stated. The examination by the person sent confirmed the statement by Mr. Emmert in every particular. This, therefore, necessitates one of two conclu-

sions,—that the mound was thrown up since 1820, or that some one was at work on the Cherokee alphabet before Mr. Guess's time. But this is a question which has no bearing on the present discussion.

[Continued on p. 330.]

DR. FREIRE'S PROTECTIVE INOCULATION.—FACTS VERSUS FIGURES.¹

THE *Medical Record* published some time since a translation of a communication, made by Dr. Domingos Freire of Brazil to the French Academy of Sciences, relating to his protective inoculations. This summary statement has been copied in this country by *Science*, and probably by other journals, and will doubtless be read by many who will never see a copy of the volume containing my official report² of investigations made in Brazil, in which I show that Dr. Freire's statistics are misleading, and that his "vaccinations" have no prophylactic value.

Dr. Freire's recent statistics have also been brought to the notice of the profession by an article by Dr. J. McF. Gaston, published in the *Journal of the American Medical Association*, March 22, 1890. In order that the profession in this country may be able to estimate Dr. Freire's statistics at their true value, I beg leave to call attention to the following facts:—

First, there has been no veritable discovery of the specific germ of yellow-fever, and consequently there is no "attenuated virus" at Dr. Freire's command with which to vaccinate against the disease. It is certain that the micrococcus, which he presented to me at the time of my visit to Brazil as his yellow-fever microbe, has nothing to do with the etiology of this disease. A careful bacteriological study of forty fatal cases, made in Havana since my return from Brazil, enables me to affirm this in the most positive manner.

There is, then, no scientific basis for the wholesale inoculations which Dr. Freire has made; and his statistics, when viewed in the light of certain facts not brought out in his publications, give no substantial support to his claims.

As my personal investigations were made in the city of Rio de Janeiro, and a majority of Dr. Freire's inoculations have been made in that city, I shall consider at present only those figures which relate to his recent inoculations in the Brazilian capital. With reference to these, Dr. Freire says in his latest publication,³—

"Between March 1 and June 30, 1889, 2,407 persons died of yellow-fever (including the deaths at the Jurajuba Hospital), 21 of whom had been vaccinated; that is to say, that 2,386 non-vaccinated persons succumbed to the disease (1,606 in the city, 800 at Jurajuba, in all)."

Now, the total population of Rio is estimated at 400,000. Let us suppose that 100,000 of this population enjoys protection from having suffered an attack of the disease: we have left 300,000 persons who may fairly be compared with those vaccinated by Freire, and who were exposed during the epidemic. The mortality upon this estimate is 1 in 125 and a fraction ($\frac{2407}{300000} = 125.7$). Among the 2,087 vaccinated, there were, according to Dr. Freire, 21 deaths (*loc. cit.*, p. 16), that is, one in 99 and a fraction ($\frac{2087}{21} = 99.38$). It will be seen that this comparison is not at all favorable to Dr. Freire's method. But no doubt he will claim that the comparison is unfair, and that the 2,087 vaccinated by him represent a greater proportion of susceptible persons than the 300,000 with whom we have compared them. Let us, then, deduct another 100,000 of the population, considering one-half as protected by a previous attack or long residence in the city. The remaining moiety includes the entire foreign population; Brazilians not born in the city of Rio; all young children, who, according to Freire, are to be classed with strangers as to susceptibility: in short, a population that may be fairly compared with those vaccinated.

¹ From the *Medical Record*.

² Annual volume of the Marine Hospital Service for 1889.

³ *Statistique des vaccinations au moyen des cultures du microbe atténué de la fièvre jaune (Rio de Janeiro, 1890).*

The ratio of mortality under this estimate is 1 in 83 and a fraction ($\frac{200000}{23880} = 83.78$). But in this comparison we have ignored some very important factors which are in favor of Dr. Freire's statistics. A large number of the deaths, no doubt, occurred among strangers who did not belong to the population of the city, and especially among the sailors on foreign vessels arriving during the epidemic, who are commonly sent to the Jurajuba Hospital when taken sick. On the other hand, we have no definite information as to the precise date when the vaccinations were practised, and no data with reference to the exposure before and after vaccination. In the statistics of previous years a very considerable number of persons were vaccinated after the epidemic had terminated; that is, persons who had passed through the epidemic season without contracting the disease were vaccinated, and counted among those supposed to be protected from an attack by this procedure. Evidently, the later in the epidemic the vaccinations were practised, the less value can be accorded to the subsequent exposure as a test of protection. Previous exposure without being taken sick is, on the contrary, evidence of comparative insusceptibility. To put those vaccinated on the same footing with the 200,000 of the population of Rio with whom we have compared them, they should have been vaccinated at the outset and exposed in the infected city throughout the epidemic season. How many were vaccinated when the epidemic had commenced to decline, or after it had practically terminated? How many left the city soon after being vaccinated? These are questions we cannot answer for 1889; but the facts with reference to 1884, 1885, and 1886 are given in my published report heretofore referred to, some extracts from which I beg leave to quote. Referring to the year 1885, I say,—

"Dr. Freire has omitted to state one very important fact with reference to vaccinations practised during the period included in this tabular statement. The date of vaccinations is not given. Fortunately, I am able to supply this omission from his journal containing the names of the vaccinated, which he kindly placed in my hands during my stay in Rio. I find from this record that the inoculations were practised as follows:—

January.....	392
February.....	342
March.....	611
April.....	139
May.....	273
June.....	813
July.....	481

"Now, it is well known that June and July are months during which yellow-fever does not prevail in Rio, and that, in fact, the month of May furnishes as a rule but few cases.

"The exposure even in an epidemic year amounts to very little during the months of May, June, and July, and may be considered practically *nil* in a year like 1885, when the whole mortality was only 278 in a city of 400,000 inhabitants. But Dr. Freire has included in his list 1,294 persons who were vaccinated during the healthy winter months of June and July, and who presumably had been exposed during the preceding comparatively unhealthy months of January, February, March, and April. If these 1,294 individuals were protected from an attack of yellow-fever by the inoculation practised in June or July, what protected them from being attacked during the preceding epidemic season? We must insist upon excluding these 1,294 persons from consideration during the year 1885, to which the report under review relates, and we think that it would be quite proper also to exclude those inoculated during the month of May, but will not insist upon this point. We have, then, to consider the value of the evidence offered by Dr. Freire as regards 1,757 inoculated persons, instead of 3,051 included by him in his statistics for the year.

"Again I find, that in 1886, as in 1885, Dr. Freire has included in his statistics a large number of persons who were vaccinated after the termination of the epidemic, and whose exposure was but little greater than that of the 1,476 imaginary persons who must be added to his list in order to give the mortality of 1 per 1,000.

"Dr. Freire has not given us the date of his vaccinations in his elaborate presentation of his statistical results, but I find from his

manuscript record that they were distributed throughout the year as follows (I place in parallel column the figures showing the total mortality from yellow-fever during the period):—

Month.	Vaccinations.	Total Deaths from Yellow-Fever.
1886.		
January.....	84	135
February.....	376	234
March.....	253	347
April.....	167	220
May.....	945	48
June.....	21	18
July.....	57	9
August.....	3	2

"This table shows that during the epidemic period, from Jan. 1 to April 30, there were 880 vaccinations, and during the same period 936 deaths occurred from yellow-fever; while during the months of May, June, July, and August, when the total mortality was but 77, the number of vaccinations was 1,026: i.e., a majority of the vaccinations were practised after the epidemic season was over, and upon persons who, no doubt, had for the most part passed through the epidemic season without contracting the disease.

"We turn now to the age of the vaccinated persons. Dr. Freire says, in his report first quoted, that the greater proportion of the deaths is comprised between one and thirty years. This is, then, the period most favorable for the development of yellow-fever. Now, it will be seen that among the number vaccinated, which we give in the second part of our statistics, 2,624 individuals are comprised in this period. But Dr. Freire has elsewhere shown us that the age which gives the greatest mortality is from twenty-one to thirty years. Let us then see what proportion of the vaccinated are included in these limits. Reference to his tables shows the deaths between twenty-one and thirty years of age to have constituted 39 per cent of the entire mortality, while only 15 per cent of the vaccinated fell within these limits of age. On the other hand, 43 per cent of the vaccinated were less than ten years of age, while the mortality for this period was only 12.5 per cent of the entire mortality. We note, also, that a large number of the children vaccinated were infants below two years of age.

"In Dr. Freire's report under review, he says, on p. 7, 'We include in these figures all the vaccinated during the two previous years who have been carefully observed during the epidemic season.'

"That portion of the sentence which I have italicized surprises me exceedingly. From what has been said, it will be seen that a careful observation of the floating population of the cortiços, in which most of the vaccinated persons resided, would be practically impossible, even with a large force of inspectors at command.

"Dr. Freire himself did not find time to make the vaccinations among these poor people of the cortiços, but delegated this work to certain apothecaries. One of these, Mr. Telles, informed me that he had himself vaccinated between three and four thousand persons. He also communicated the startling information that none of those inoculated with the 'attenuated microbe' of yellow-fever had contracted small-pox during the recent epidemic in Rio, leaving me to infer that the vaccine was a protection against both diseases. This intelligent(?) apothecary, a mulatto, recorded a large portion of the statistics which Dr. Freire has tabulated."

I have said enough to show Dr. Freire's method of manufacturing statistics, and must refer the reader who desires fuller details to my published report. GEORGE M. STERNBERG, M.D.

SCIENCE:

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

PUBLISHED BY

N. D. C. HODGES,

47 LAFAYETTE PLACE, NEW YORK.

SUBSCRIPTIONS.—United States and Canada..... \$3.50 a year.

Great Britain and Europe..... 4.50 a year.

Communications will be welcomed from any quarter. Abstracts of scientific papers are solicited, and twenty copies of the issue containing such will be mailed the author on request in advance. Rejected manuscripts will be returned to the authors only when the requisite amount of postage accompanies the manuscript. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a guaranty of good faith. We do not hold ourselves responsible for any view or opinions expressed in the communications of our correspondents.

Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

VOL. XV. NEW YORK, MAY 30, 1890. No. 382.

CONTENTS:

THE CHEROKEES IN PRE-COLUMBIAN TIMES. <i>Cyrus Thomas</i> ... 323	The Winnebago County (Iowa) Meteorites. <i>J. E. Todd</i> 333
DR. FREIRE'S PROTECTIVE INOCULATION. <i>George M. Sternberg</i> 328	Tornadoes. <i>M. A. Veeder</i> 333
LETTERS TO THE EDITOR.	BOOK-REVIEWS.
Dr. Hann's Studies on Cyclones and Anticyclones. <i>W. M. D.</i> ... 3:2	Electricity in Modern Life..... 334
An Hypothesis for the So-called Encroachments of the Sea upon the Land. <i>Gilbert Thompson</i> ... 333	Evolution and Disease..... 334
	A Course of Lectures on the Growth and Means of Training the Mental Faculty..... 334
	AMONG THE PUBLISHERS..... 335

THE CHEROKEES IN PRE-COLUMBIAN TIMES.

II.

[Continued from p. 323.]

What has been presented is probably sufficient to convince any unbiassed mind that the Cherokees were mound-builders, nevertheless there is other evidence of a more general character which serves to show that the builders of the East Tennessee and North Carolina mounds were contemporaneous with the authors of the works of other sections.

Proof that in general the mound-builders were Indians would, as a matter of course, have a strong bearing on the case under discussion, but this would require too much space to be introduced here. The following extracts from Major J. W. Powell's article on "Prehistoric Man in America," in the *Forum* of January, 1890, will give what is now becoming the settled conclusion of most of the leading archæologists of the present day:—

"The research of the past ten or fifteen years has put this subject in a proper light. First, the annals of the Columbian epoch have been carefully studied, and it is found that some of the mounds have been constructed in historical time, while early explorers and settlers found many actually

used by tribes of North American Indians: so we know many of them were builders of mounds. Again, hundreds and thousands of these mounds have been carefully examined, and the works of art found therein have been collected and assembled in museums. At the same time, the works of art of the Indian tribes, as they were produced before modification by European culture, have been assembled in the same museums, and the classes of collections have been carefully compared. All this has been done with the greatest painstaking, and the mound-builders' arts and the Indians' arts are found to be substantially identical. No fragment of evidence remains to support the figment of theory that there was an ancient race of mound-builders superior in culture to the North American Indians. . . . It is enough to say that the mound-builders were the Indian tribes discovered by white men."

Once it is admitted that the mound-builders were Indians, it requires much less proof to carry conviction that a particular tribe was accustomed to erect such structures. There are, however, two facts which seem to carry back the Cherokees to the mound-building age, even independently of this general argument.

The first of these to which attention is called is that afforded by a certain class of stone graves or cists found in great numbers in some sections. These cists, usually designated "box-shaped stone graves," are formed of rough unhewn slabs or flat pieces of stone, thus: first, in a pit some two or three feet deep and of the desired dimensions, dug for the purpose, a layer is placed to form the floor; next, similar pieces are set on edge for the sides and ends, over which other slabs are laid flat, forming the covering; the whole, when finished, making a rude box-shaped coffin or sepulchre. Sometimes one or more of the six faces are wanting; occasionally the bottom consists of a layer of water-worn boulders; sometimes the top is not a single layer, but other pieces are laid over the joints; and sometimes they are placed in the fashion of shingles. They vary in length from fourteen inches to eight feet, and in width from nine inches to three feet.

Now, it happens that quite a number of graves of this particular type are found on the site of one of the "Over-hill towns" heretofore mentioned, and others are scattered over parts of the Cherokee district. As the location of those about the village site is such as to justify the belief that they were contemporaneous with the existence of the village, we must conclude that the authors of the graves of this type, and the Cherokees, were contemporaneous. Additional proof of this is found in the seemingly conclusive evidence, which is too lengthy to be introduced here, that the graves of this form found south of the Ohio are due to the Shawnees. The well-known fact that the Cherokees and Shawnees were long hereditary and bitter foes, almost constantly at war with each other, would seem to forbid the above supposition that a Shawnee colony was living in connection with a Cherokee village; yet the following historical items furnish a satisfactory explanation.

Haywood, in his "Natural and Aboriginal History of Tennessee," gives the following statement by Gen. Robertson: "In 1772 the Little Corn-Planter, an intelligent Cherokee chief who was then supposed to be ninety years of age, stated, in giving a history of his own nation, that the Sa-

vannechers, which was the name universally given by the Indians to those whom the English call Shawnees, removed from Savannah River, between Georgia and South Carolina, by permission of the Cherokees, to Cumberland, they having been attacked and almost ruined by a combination of several of the neighboring tribes of Indians; that many years afterwards a difference took place between the two nations, and the Cherokees, unexpectedly to the Shawnees, marched in a large body to the frontier of the latter."

There is, however, another item of evidence directly in point found in the following statement in Schoolcraft's "History of the Indian Tribes:" "A discontented portion of the Shawnee tribe from Virginia broke off from the nation which removed to the Scioto country in Ohio about the year 1730, and formed a town known by the name of 'Lulbegrud' in what is now Clark County (Kentucky), about thirty miles east of this place (Lexington). This tribe left this country about 1750, and went to East Tennessee, to the Cherokee nation." It is very probable that the stone graves about the sites of the "Over-hill towns" are due to this band.

The importance and bearing of this evidence in the present connection lie in the fact that numbers of graves of this type are found in mounds, some of which are of comparatively large size, and connected with works which no one hesitates to attribute to the true mound-building age. Sometimes they are arranged in these tumuli in two, three, and even four tiers. Not only are they found in mounds of considerable size, but they are also connected with one of the most noted groups in the United States; namely, the one on Col. Tumlin's place, near Cartersville, Ga., known as the "Etowah mounds," of which a full description will be found in the "Fifth Annual Report of the Bureau of Ethnology" and in Jones's "History of the Southern Indians." In the smallest of the three large mounds of this group were found stone graves precisely of the type described; not in a situation where they could be attributed to intrusive burial, but in the bottom layer of a mound some thirteen or fourteen feet high, with a thick and undisturbed layer two feet thick of hard-packed clay above them. In them were found the remarkable figured copper plates and engraved shells which are described by the writer in the "Fifth Annual Report of the Bureau of Ethnology," also in *Science*. In singular corroboration of the idea here advanced, the only other similar copper plates were found in a stone grave at Lebanon, Tenn.; in a stone-grave mound at Mill Creek, southern Illinois; in a stone grave in Jackson County, Ill.; in a mound of Madison County, Ill.; and in a small mound at Peoria, Ill.; not all, of course, attributed to Shawnees, but in stone graves or mounds, thus connecting them with the mound-building age, which is the only point with which we are at present interested.

Another important link in this discussion is found in the engraved shells, of which specimens were found in the mounds of North Carolina and East Tennessee, attributable to the Cherokees.

The following list, showing localities where and circumstances under which specimens have been found, will suffice to show their relation to the mounds and stone graves: Lick Creek, and near Knoxville, E. Tenn., in mound; near Nashville, Tenn., in mound, also in stone grave; Old Town, Franklin, and Sevierville, Tenn., in mound; Bartow Coun-

ty, Ga., in stone grave in mound; Monroe County, E. Tenn., Lee County, Va., and Caldwell County, N.C., in mound; near Mussel-Shoals, Ala., in cave; New Madrid, Mo., and Union County, Ill., in mound; St. Clair County, Ill., in stone grave.

As a large number of these bear exactly the same carved designs as those found in the Cherokee mounds, the evidence seems conclusive that we must assign them to the same age. This, of course, connects the Cherokees with the mound-builders' era, and furnishes a justifiable basis for another backward step. But before attempting to take this, I add some information on the point now under discussion, gathered by Mr. James Mooney during his ethnological investigations among the Cherokees in behalf of the Bureau of Ethnology. This is given in a paper read before the Anthropological Society.

"In connection with my work, at the instance of the Bureau of Ethnology, in the summer of 1887, I visited the East Cherokee reservation in western North Carolina. Being delayed over night at a small town called Webster, about twenty miles from the reservation, an opportunity was afforded to make the acquaintance of Capt. J. W. Terrell, the postmaster, an intelligent American, who in his younger days had been a trader among the Cherokees, and who has some knowledge of the language. In the course of our conversation he stated that about thirty years ago he had been told by an old Indian named Tsiskwaya that the Cherokees had built the mounds in their country, and that on the occasion of the annual green-corn dance it was the custom in ancient times for each household to procure fresh fire from a new fire kindled in the town-house. I afterward found that this Tsiskwaya had been regarded as an authority on such matters.

"Subsequently, in investigating the ceremonies of the green-corn dance, this statement was confirmed by another old man, who volunteered the additional information that it was customary to begin a mound on the occasion of this dance, when representatives of the seven gentes brought baskets filled with earth, which was placed in a common pile with appropriate ceremonies, and afterward added to by the labors of the common people. This man is somewhat unreliable, and his testimony would have little weight by itself, but it is of value in so far as it is borne out by the statements of others. It is proper to state, however, that he was one of the masters of ceremonies at the green-corn dance of 1887, so that he may reasonably be supposed to know something on that subject. Of curious interest in this connection is the fact that Miss Alice C. Fletcher witnessed a similar ceremonial mound-building at one of the secret rites of the Winnebagoes.

"But the most detailed statement as to the mounds was obtained afterward from Ayunini ('Swimmer'), who, although not an old man, is one of the most prominent Cherokee shamans and a general conservator of Indian knowledge, being probably better acquainted with the myths, traditions, and ceremonial formulas than any other man of the tribe. For some time he refused to talk, but this difficulty was finally overcome by appealing to his professional pride; and his stock of Indian lore proved so extensive, that I brought him to the house, and kept him with me most of the time. This aroused the jealousy of rivals, who took occasion to circulate

damaging reports as to his honesty; but in every instance I found his statements borne out by other testimony or by general analogy. Making due allowance for the mythologic features, which rather serve to establish its traditional character, his account is probably as full and accurate as could be expected at this late day, and briefly is as follows:—

“The practice of building mounds originated with the Anintsi, and was kept up by the Ani-Kituhwagi. They were built as sites for town-houses (see Bartram's account of Cowe mound and town-house); and some were low, while others were as high as small trees. In building the mound, a fire was first kindled on the level surface. Around the fire was placed a circle of stones, outside of which were deposited the bodies of seven prominent men, one from each gens, these bodies being exhumed for the purpose from previous interments.’

“Swimmer said that his statement was obtained from a man who died in 1865, aged about seventy. Some time later, while talking with an intelligent woman in regard to local points of interest, she mentioned the large mound near Franklin, in Macon County, and remarked, ‘There's fire at the bottom of that mound.’ Without giving her any idea of what Swimmer had said, I inquired of her how the fire got there, when she told substantially the same story as she had obtained it from an old woman now dead. She was of the opinion that this fire existed only in the larger mounds; but I found on investigation that the belief was general that the fires still existed, and occasionally sent up columns of smoke above the tops of the mounds.”

CYRUS THOMAS.

[To be continued.]

LETTERS TO THE EDITOR.

** * Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The editor will be glad to publish any queries consonant with the character of the journal.

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

Dr. Hann's Studies on Cyclones and Anticyclones.

ON April 17, Dr. Julius Hann, director of the meteorological observatory at Vienna, presented to the Vienna Academy an essay on “The High Pressure Area of November, 1889, in Central Europe, with Notes on High-Pressure Areas in General.” The particular value of the essay lies in the comparison of records from lofty Alpine stations with those from the surrounding low country; the highest station being on the Sonnblick, over 3,100 metres above sea-level. The anticyclone of November, 1889, was chosen because it lay over the Alpine region from the 12th to the 24th of the month, giving ample time for the full determination of its persistent features. The results of the study are thus summarized:—

1. The barometer maximum of November, 1889, extended to a great height in the atmosphere, and was as pronounced at a height of 3,000 metres as at sea-level. At a height of 2,500 metres, the centre of high pressure lay over that at the earth's surface.

2. The body of air in the anticyclone had a high temperature. At 3,000 as well as at 1,000 metres, the temperature stood 8° C. above the mean. The usual depression of temperature, characteristic of winter anticyclones, was limited to the lower layers of air, next to the earth's surface, and was only a few hundred metres thick. The mean excess of temperature over the normal at successive heights up to 3,100 metres, for the period from the 19th to the 23d of November, can be estimated as at least 6° C. An excess of temperature must, at the most moderate

determination, have extended up to a height of 5,000 metres.

3. In the upper air, above 1,000 metres altitude, a great dryness prevailed. The mean relative humidity from the 19th to the 23d of November on the Sonnblick (3,100 metres) was only 43 per cent, and on the Säntis (2,500 metres) 34 per cent, according to carefully reduced psychrometer records. Hair hygrometers gave a still lower percentage.

Dr. Hann sees in these facts a strong proof of the descending movement of the air in anticyclones, such as is generally accepted. He then goes further in saying that the motion of the air is not a product of the temperature, but is in spite of it: the temperature is a product of the motion.

A study is then made, for purposes of comparison, of an area of low pressure that passed nearly centrally over the eastern Alps on Oct. 1, 1889. Here the temperature of the air-column averaged 4.3° C. below the thirty-year normal for the time and place. Although earlier in the season, the air in this cyclone was absolutely colder than that in the later anticyclone. Even while a warm foehn was blowing down the northern valleys of the eastern Alps, the temperature on the Sonnblick was distinctly below the normal. In reviewing this, Dr. Hann says that it is the high mountain stations, recently founded, that have freed us from the prejudices into which we have been led by observations at low levels. It has been thought that the temperature of cyclones and anticyclones was the chief condition of their motion; but it appears certain from the foregoing, that the theory of cyclones must take account of the fact, that, up to the height of at least four or five kilometres, the central air-column of an anticyclone may be, and probably always is, warmer than that of a cyclone.

It is manifest that this contradicts the prevailing theory of the convectional origin of cyclones and anticyclones, while it confirms the views of those who, like Dr. Hann, regard cyclones and anticyclones as merely subordinate members of the general circulation of the atmosphere, their energy coming from the fundamental and persistent difference of temperature between the equator and the poles. According to this view, as Dr. Hann says, the temperature of the air-masses in cyclones and anticyclones is the product of their motions, and not *vice versa*. In the stationary cyclonic circulation of the far northern Atlantic, and in the winter anticyclones of the continents, differences of temperature are probably operative. Hence the author agrees with Teisserenc de Bort in distinguishing between thermic and dynamic cyclones and anticyclones. Moreover, in dynamic cyclones, the evolution of latent heat will maintain the air-mass at a higher temperature than that to which it would otherwise be reduced; but even then, the descending air in the adjacent anticyclone will be warmer as a whole than that which ascends in the cyclone.

This most interesting conclusion as to the origin of cyclones is a surprise to me; and therefore, having frequently advocated the sufficiency of the convectional theory of cyclones, I now make haste to place Dr. Hann's observations before the readers of *Science*, that they may see how clearly a revision of opinion is called for. The apparently convectional circulation in cyclonic storms is not doubted. There is unquestionably an ascending component of motion in cyclonic areas, and a descending component in anticyclones. It also appears to be generally true that at the earth's surface, temperatures above the normal are noted in cyclones, and below the normal in anticyclones. It cannot be doubted that the evolution of latent heat from condensing vapor in the rainy cyclonic area would favor any convectional movement that had originated from other causes. For all these reasons, the convectional theory came into favor, and other possible explanations were little considered. The convectional theory is merely a local application of a theory that is universally accepted to account for the general circulation of the atmosphere between equator and poles; but the tests now furnished by high-level observations seem to show that the local application of the theory is incorrect.

This is as if an observer who was familiar with stationary steam-engines should see a train of cars for the first time: he would rather naturally say that the locomotive was the motor of the train; he would hardly suggest the possibility that the motor was concealed in the rear car, and that the driving-wheels of the

locomotive made the piston-rod move in the cylinder; in fact, that the engine was a dummy. And yet this curious conclusion appears to be analogous to the one now presented by Dr. Hann. The cyclonic machine does not drive itself by its own store of energy: it is driven by an external motor, the general circulation of the winds. Some of the warm tropical cyclones may at first depend on their own energy; these would be true motors: but, if the definite records quoted by Dr. Hann prove to be of wide application, cyclones generally may come to be considered dummies. The cyclonic air does not rise because it is warm, but, according to Dr. Hann, it is lifted in spite of becoming cool. The anticyclonic air does not sink because it is cold, but is pushed down in spite of becoming warm. The ascending air is cooler than the normal because its adiabatic rate of cooling by expansion in ascent is, on the whole, greater than the mean vertical temperature gradient of the atmosphere; the descending air is warmer than the normal because its adiabatic rate of being warmed by compression in descent is greater than the mean vertical temperature gradient. Cyclones do not work themselves: they are worked by the general winds.

Redfield advocated a theory analogous to this in his early essays. He suggested that cyclones are not generated at places of rarefaction, but are only eddies in the general winds. Other early observers made similar suggestions; but it was not then possible to deduce tests by which this eddy theory could be confirmed or excluded. Faye's modification of Redfield's theory involves so many contradictions to well-established physical facts and laws, that it receives little acceptance. Espy was the first to call attention to the general occurrence of convectional movements in the atmosphere, and to the importance of liberated latent heat in promoting these movements. Reye, in later years, gave precision to Espy's ideas, and advanced the convectional theory greatly in the estimation of many meteorologists. I do not see that his deductions are in any way inaccurate. His calculation of the available horse-power supplied by the latent heat in a tropical cyclone appears to be pertinent, even under Hann's new interpretation of the cause of cyclonic movements. But through all the statements of the convectional theory, it has been tacitly assumed that the warmed air of the cyclone would be cooled by radiation in the anticyclonic area; and this does not seem to be the fact. The anticyclonic air is not much cooled till it approaches the ground; and in this we find confirmation of Searle's theory concerning the atmospheric economy of solar radiation.

The warmth of the body of air in anticyclones has been recognized for some time. Dr. Hann was among the first to give proper emphasis to the fact; but its relation to the convectional theory of cyclones has been slowly perceived. In this country, Hazen has drawn attention to the absence of indication of the "neutral plane," called for deductively; and for this and other reasons he has discarded pretty much all parts of the cyclonic theory, following Faye more closely than any other. The reason why Dr. Hann's objection to the convectional theory of cyclones appears to me so cogent and convincing is that it is presented, not as a contradiction, but as a corollary to the principles of modern physical meteorology, with which this eminent meteorologist is so thoroughly familiar, and to which he has himself contributed so much of value. The theory of the foehn, for example, was known in a general deductive way from the suggestions made independently by Espy, Dove, Tyndall, Helmholtz, and others; but it was demonstrated by Hann. So in the present case: Redfield and many others have thought that the general circulation of the atmosphere might produce cyclones and anticyclones, somewhat in the way that rivers form eddies when flowing in an uneven channel; but there is a long distance between suggestion and proof. General indefinite suggestion of what is afterwards shown to be the correct view is not much superior to the suggestion of what ultimately turns out to be the wrong view. Precise definition and demonstration are of much higher value, and these qualities are truly characteristic of Hann's work. If further observation prove the general applicability of these newer views as to cyclones and anticyclones, the credit of the demonstration will go primarily to Dr. Hann.

W. M. D.

Harvard College, May, 1890.

An Hypothesis for the So-called Encroachments of the Sea upon the Land.

It is assumed that there is no substance which is absolutely rigid. The earth is a plastic mass. Let a mountain-range disappear, the plain on which it once stood rises when relieved of its weight. Let a lake disappear, and its bed becomes contorted, and the contour of its shore-line is changed. The walls of the Grand Cañon of the Colorado are moving toward each other, and, should it become an arid chasm, they would some time meet.

Now, in the southern and eastern portions of the United States the "fall-line" is the boundary of the permanent continent. The "continental outline" is the one-hundred fathom hydrographic contour, as determined by the United States Coast Survey; and from its crest there is a drop of over three thousand feet, — a front equal to one side of the Grand Cañon. From the "fall-line" to this front there is a creeping-forward, which is comparable to the ice sheets of Greenland: therefore cannot we say that the land at present is crowding down into the sea, instead of the sea encroaching upon the land, which is only an apparent movement, not the real one? The distance from the backbone of the Appalachians to the historic-geologic cedar-stumps of the New Jersey coast has increased, and is increasing.

The deltas of the Mississippi valley and the Gulf coast are not only increasing by deposits of sediment, but are moving forward as well. Therefore may it not be expected in geodetic work on the North American continent that there will be encountered discrepancies between successive determinations of positions which can only be thus accounted for and understood?

GILBERT THOMPSON,

Washington, D.C., May 23.

The Winnebago County (Iowa) Meteorites.

AS the Iowa meteor of May 2 has received notice in your paper, it may be desirable to make the record still more complete. I therefore offer the following notes from the south-western corner of that State. The writer was not in position to see it, nor did the sounds appear to him enough unlike thunder to attract particular attention at the time. It was seen by perhaps a dozen citizens of this place, one of them being at the time less than ten miles from the south-west corner of the State. Most agree in thinking that it passed from the south-west toward the north-east. Some who saw it felt so sure that it struck fields close by to the north north-east, that they searched diligently for it. Many heard it, and thought it thundered. Some compared it to an earthquake shock, the jarring of the ground was so evident. Four distinct explosions were observed by one. A local paper of Malvern, nine miles away, stated that three pieces had fallen in that vicinity, but the statement was based on observations similar to those already given.

J. E. TODD.

Tabor, Io., May 20.

Tornadoes.

SOME years since, I visited the scene of a small tornado shortly after its occurrence, and found the arrangement of tree trunks and other *débris* in its track very similar to what is represented in the article by Professor Hazen at p. 318 of *Science* for May 23. It seemed to me, however, that the peculiar arrangement found might be due to the combined effect of a whirling motion of the tornado, together with its motion of translation as a whole. In such a case there must be a compounding of forces, and the direction of the fall of a tree or other object can only be determined theoretically by a somewhat elaborate computation. Practically, and as a matter of fact, I have noticed, however, that when a small whirlwind is passing over a corn-field, the stalks incline inward toward its centre with a twisting motion, and likewise bend forward in the direction toward which it is advancing. I have never seen stalks actually uprooted and left prostrate in this way; but it looks very much as if they would be left with their tops inward and forward if this should happen, thus corresponding precisely to what is found after tornadoes.

M. A. VEEDER.

Lyons, N.Y., May 23.

BOOK-REVIEWS.

Electricity in Modern Life. By G. W. TUNZELMANN. New York, Scribner & Welford. 12°. \$1.25.

THIS is the second volume of the Contemporary Science Series, a series of inexpensive and handy illustrated books intended to bring within the reach of the general public the "best that is known and thought in all departments of modern scientific research." The scope of the series is broad, but the character of the few volumes issued (some of which have been already noticed in these columns), and the high standing of the writers engaged on forthcoming works, are a guaranty that the subjects are and will be not only well selected, but ably handled.

Owing to the prominent place now occupied by electrical science, it will be readily understood that Professor Tunzelmann's volume is one of the most important in the series. For this reason much will be expected of it; more, perhaps, than should be looked for in a work of its modest size. The field is so large, the ramifications of the subject are so many, and the connections with kindred subjects are so close and so complicated, that the author's work was doubly difficult; but it must be admitted that he has succeeded in giving us a volume fulfilling every requirement of the prospectus quoted above. The more important of the many useful functions of electricity in our daily life, the scientific principles underlying its practical applications, and the history of their development, are briefly but clearly sketched.

Being intended primarily for the use of readers without previous knowledge of the subject, it begins with the familiar but necessary sealing-wax and glass-rod phenomenon, and leads the reader step by step to the modern commercial applications of electricity, as exemplified in the telegraph, telephone, lighting, and the transmission of power. None of the many modern uses to which electrical energy has been adapted appears to have been neglected, though of course the space devoted to many of them is brief. There are errors in the book, more or less important, ac-

cording to the point from which they are viewed. They will attract the attention of the electrician and the engineer, and have doubtless been pointed out to the author ere this, but they will scarcely detract from the value of the volume for those for whom it is intended.

Evolution and Disease. By J. BLAND SUTTON. New York, Scribner & Welford. 12°. \$1.25.

To demonstrate that there is a natural history of disease as well as of plants and animals was the object the author had in mind in writing this book. The science of disease, or pathology, is generally regarded as of interest only to medical men; yet it is but a department of biology, and should therefore be studied by all who desire to make themselves masters of this science. The basis of the author's argument is, that, as there has been a gradual evolution of complex from simple organisms, it necessarily follows that the principles of evolution ought to apply to diseased conditions if they hold good for the normal or healthy states of organisms: in plain words, there has been an evolution of disease *pari passu* with evolution of animal forms. The author recognizes the difficulty of the task which he has set himself to perform. He thinks that a more extended study will serve to show that many of his conclusions are fallacious, and he candidly invites corrections from all who have opportunities of practically testing his theories. He has certainly succeeded in presenting his subject in a most attractive form, and has apparently succeeded in sustaining the points which he has made. We shall, however, before accepting his claims as proven, wait until his theories have been more fully tested.

A Course of Lectures on the Growth and Means of Training the Mental Faculty. By FRANCIS WARNER. Cambridge, Eng., University Pr. 16°. 90 cents.

THE title of this book is a misnomer, there being very little in it about mental faculty. Dr. Warner's views of human na-

Publications received at Editor's Office,
May 19-24.

- CENTURY DICTIONARY, The. Vol. III. G to L. New York, The Century Co. 1134 p. f°. 80 cents.
- CHAMBERS'S ENCYCLOPEDIA. New ed. Vol. V. Friday to Humanitarians. Philadelphia, Lippincott. 823 p. 8°. 83 cents.
- HACKEL, E. The True Grasses. Tr. by F. Lamson-Scribner and Effie A. Southworth. New York, Holt. 228 p. 8°. \$1.50.
- ILLINOIS, Sixteenth Report of the State Entomologist on the Noxious and Beneficial Insects of the State of. Fifth Report of S. A. Forbes, for the Years 1887 and 1888. Springfield, State. 226 p. 8°.
- MONTIFIORÉ, A. Henry M. Stanley, the African Explorer. 4th ed. New York and Chicago, Fleming H. Revell. 192 p. 12°. 75 cents.
- MOUCHEZ, E. Rapport Annuel sur l'Etat de l'Observatoire de Paris, pour l'Année 1889. Paris, Gauthier-Villars. 27 p. 4°.
- RIO DE JANEIRO, Annales de l'Observatoire Impérial de. Publiées par L. Cruls. Tome IV. Parts I, II. Rio de Janeiro, H. Lombaerts & C. 529 p. f°. Annuaire Publicado pelo Imperial Observatorio do, para o Anno de 1888. Rio de Janeiro, H. Lombaerts & C. 343 p. 12°.
- Same. 1889. Rio de Janeiro, H. Lombaerts & C. 322 p. 12°.
- Annuaire Publicado pelo Observatorio Astronomico do, para o Anno de 1890. Rio de Janeiro, H. Lombaerts & C. 386 p. 12°.

Old and Rare Books.

Back numbers Atlantic, Century, Harper and Scribner, 10 cents per copy, other magazines equally low. Send for a catalogue.

A. S. CLARK,

Bookseller.

34 Park Row, New York City.

CATALOGUE No. 7. Americana and Natural History now ready.

S. H. CHADBOURNE, Dealer in Old Books,
57 Warren St., Roxbury, Mass.

BACK NUMBERS and complete sets of leading Magazines. Rates low. AM. MAG. EXCHANGE, Schenectady, N.Y.

SECOND EDITION.

NATURALISTIC PHOTOGRAPHY FOR STUDENTS OF THE ART.

313 pages 8vo., cloth, \$2.00, postage prepaid. "This book contains a greater amount of information on the artistic elements to be considered in photography than any that we know of."—*Scientific American*. Descriptive circulars on application to E. & F. N. SPON, 12 Cortlandt St., New York.

HEAVEN AND HELL. 416 p., paper. DIVINE LOVE AND WISDOM. 383 p., paper. By EMANUEL SWEDENBORG. Mailed, prepaid, for 14 cents each (or 25 cents for both), by the American Swedenborg P. and P. Society, 20 Cooper Union, N.Y. City.

BOOKS 50,000 vols. of ancient and modern rare and scarce books offered for sale. Send for books tried to obtain elsewhere without success. American, British, German and French Books. Catalogues mailed free to Bookbuyers. C. N. CASPAR, Book Emporium 437 E. W. St., Milwaukee

Correspondence solicited with parties seeking publishers for scientific books. Short monographs on scientific questions of general interest are especially desired.

N. D. C. HODGES,

Publisher of Science,

47 Lafayette Place,

New York.

BOOKS: How to Exchange them for others. Send a postal to the SCIENCE exchange column (insertion free), stating briefly what you want to exchange. SCIENCE, 47 Lafayette Place, New York.

THIRD EDITION.

THE FAULTS OF SPEECH

BY

A. MELVILLE BELL,

Author of "Visible Speech," etc., etc.

The Faults of Speech is a Self-Corrector and Teacher's Manual, for the removal of all Impediments and Defects of Articulation.

60 Cents.

** Sent postpaid on receipt of price,

N. D. C. HODGES, 47 Lafayette Place,
NEW YORK.

ANY OF

Prof. A. MELVILLE BELL'S WORKS

—ON—

Elocution — Visible Speech — Principles of Speech — Faults of Speech — Phonetics — Line Writing — World - English, etc.,

SUPPLIED BY

N. D. C. HODGES,
47 Lafayette Place, N.Y.

BOOKS: How to get them. If there is any book or pamphlet that you want, write to the Science Book Agency, 47 Lafayette Place, New York.

ture are very frankly and decidedly materialistic. He says that he has "found it convenient to omit from the definitions and descriptions here used all terms implying subjective conditions which are incapable of direct observation by our senses" (p. 37). In another place he speaks of "the physical action called 'thought'" (p. 39); and again he expresses the opinion that "thought consists in the formation of the union of cells whose motor or efferent action produces expression of the thought" (p. 40). A considerable part of the book is taken up by general discussions about the brain, the body, and the life of animals and plants, much of which has no bearing on the ostensible subject of the work. Whenever we come to the essential part of the book, we find it to be in the main a study of abnormal and pathological states of young children, with advice as to the best mode of dealing with them. On these points he shows abundant knowledge, and makes suggestions that we should think teachers would find useful. He is specially concerned for children that have some mental or physical defect, and points out how faults of temper, as well as inattention and idleness, often arise from physical defect or from weariness. At the end of the book is a catalogue of a museum of natural history, such as the author has found useful in giving instruction, and which will doubtless be interesting to teachers.

AMONG THE PUBLISHERS.

THE question of hours of labor is discussed by Gen. Walker in the *Atlantic* for June. This and Hannis Taylor's consideration of "The National House of Representatives: Its Growing Inefficiency as a Legislative Body," are the two articles which make up the solid reading of the number.

—"With Fly-Rod and Camera" is the title of an elaborately illustrated work announced for immediate publication by the Forest and Stream Publishing Company. The author is Edward A. Samuels of Boston. The book contains 150 full page reproductions of photographs, to the collection of which Mr. Samuels has devoted the vacations of several years on the picturesque salmon rivers of Canada.

—The size of the *American Machinist* has been increased to twenty pages, the four pages thus added being divided between

readers and advertisers. On and after June 1, 1890, the subscription price will be increased to three dollars a year, and the newsstand retail price to six cents a copy.

—Not all new things come from the effete East. The Bannack and Crow Indians and other tribes in the northern Rockies are laboring with an extraordinary delusion that Christ has come to earth, and is now in the Big Horn Mountains, somewhere between Fort Custer and Fort Washakie, Wyoming Territory. Gen. James S. Brifbin, U.S.A., commanding in Montana, has in the *New York Ledger* of May 17 an interesting letter concerning the hallucination, and giving full and interesting details about it.

—Messrs. Houghton, Mifflin, & Co. have in preparation an entirely new and complete large-paper edition of the writings of James Russell Lowell. These have been re-arranged by Mr. Lowell, and will appear in volumes not bearing the titles by which his works have heretofore been known, but titles suggested by the new classification. Thus there will be "Literary Essays," in four volumes; "Political Essays," in one volume; "Literary and Political Addresses," in one volume; "Poems," in four volumes. These will comprise all of Mr. Lowell's writings up to date which he wishes to preserve, and will include several addresses, etc., not contained in his volumes hitherto published. Mr. Lowell has carefully revised the whole, prose and poetry. To "The Biglow Papers," which owed their great effectiveness, at the time of their publication, to their many personal and political allusions almost as much as to their wit, full explanatory notes are added, which will render these remarkable papers more intelligible to readers of this and future generations. Thus his writings in this issue will bear the form which he regards as final, and which for the future will represent his definitive contribution to the world's literature.

—In the Department of Arizona, on May 17, Lieut. Wittenmeyer succeeded in signalling a message by a signal-flash 125 miles from Mount Reno, near Fort McDowell, to Mount Graham, near Fort Grant, where it was received by Capt. Murray. The latter, by turning his instrument, flashed the message to Fort Huachuaca, a distance of 90 miles, making a distance of 215 miles with only one intervening station. This is the best work yet accomplished in heliography, the longest distance heretofore made with a signal-flash being only about 70 miles.

SCOTT'S EMULSION

Of Pure Cod Liver Oil with
Hypophosphites
Of Lime and Soda.

There are emulsions and emulsions, and there is still much skimmed milk which masquerades as cream. Try as they will many manufacturers cannot so disguise their cod liver oil as to make it palatable to sensitive stomachs. Scott's Emulsion of PURE NORWEGIAN COD LIVER OIL, combined with Hypophosphites is almost as palatable as milk. For this reason as well as for the fact of the stimulating qualities of the Hypophosphites, Physicians frequently prescribe it in cases of

CONSUMPTION,

SCROFULA, BRONCHITIS and
CHRONIC COUGH or SEVERE COLD.
All Druggists sell it, but be sure you get
the genuine, as there are poor imitations.

Readers of Science

Corresponding with or visiting Advertisers.
will confer a great favor by mentioning this paper.

A New Method of Treating Disease.

HOSPITAL REMEDIES.

What are they? There is a new departure in the treatment of disease. It consists in the collection of the specifics used by noted specialists of Europe and America, and bringing them within the reach of all. For instance, the treatment pursued by special physicians who treat indigestion, stomach and liver troubles only, was obtained and prepared. The treatment of other physicians celebrated for curing catarrh was procured, and so on till these incomparable cures now include disease of the lungs, kidneys, female weakness, rheumatism and nervous debility.

This new method of "one remedy for one disease" must appeal to the common sense of all sufferers, many of whom have experienced the ill effects, and thoroughly realize the absurdity of the claims of Patent Medicines which are guaranteed to cure every ill out of a single bottle, and the use of which, as statistics prove, has ruined more stomachs than alcohol. A circular describing these new remedies is sent free on receipt of stamp to pay postage by Hospital Remedy Company, Toronto, Canada, sole proprietors.

JUST PUBLISHED.

POPULAR MANUAL OF VISIBLE SPEECH AND VOCAL PHYSIOLOGY.

For use in Colleges and Normal Schools. Price 50 cents.
Sent free by post by

N. D. C. HODGES, 47 Lafayette Place, New York

Sewer Gas

and all other

Noxious Vapors

are rendered Harmless,

and

TRADE MARK
Pure Air
INSURED BY
USING "The Sherman King Vaporizer"
SELF-ACTING.
CONTINUOUS, INEXPENSIVE, RELIABLE.

ALL IMPURE AND OFFENSIVE ODORS ABSOLUTELY REMOVED.

For Homes, Schools, Vestries, Halls.

ILLUSTRATED PAMPHLET FREE.

Each Vaporizer sold charged for use. No care except to replenish once in two months at expense of 4 to 8 cents, according to size. Three sizes, \$3.50, \$5.00, \$8.00.

SHERMAN "KING" VAPORIZER COMPANY,
Chicopee Falls, Mass.; Boston, New York,
Philadelphia, or Chicago.

CALENDAR OF SOCIETIES.

Anthropological Society, Washington.

May 20.—R. E. C. Stearns, The Nishinam Game Ha and the Boston Game Props; F. Webb Hodge, Zuni Foot Race; J. W. B. Hewitt, Genesis Myth of the Iroquois.

Philosophical Society, Washington.

May 24.—H. G. Ogden, Chart-Making; Frederick W. True, An Epitome of the Natural History of the Puma.

CATARRH

Catarrhal Deafness—Hay Fever.

A NEW HOME TREATMENT.

Sufferers are not generally aware that these diseases are contagious, or that they are due to the presence of living parasites in the lining membrane of the nose and eustachian tubes. Microscopic research, however, has proved this to be a fact, and the result of this discovery is that a simple remedy has been formulated whereby catarrh, catarrhal deafness and hay fever are permanently cured in from one to three simple applications made at home by the patient once in two weeks.

N.B.—This treatment is not a snuff or an ointment; both have been discarded by reputable physicians as injurious. A pamphlet explaining this new treatment is sent free on receipt of stamp to pay postage, by A. H. Dixon & Son, 337 and 339 West King Street, Toronto, Canada.—*Christian Advocate*.

Sufferers from Catarrhal troubles should carefully read the above.

CHEMICAL BOOKS FOR SALE.

BERICHTE der Deutschen Chemischen Gesellschaft (1883-87 inclusive)..... \$8.50
JOURNAL of the Chemical Society of London (1884-'6, 1889)..... 3 60
ANALYST, London (1887-'89, July and November of 1888 missing)..... 1.80
SUGAR CANE, Manchester (1881-'83, 1885-'86, also numbers of 1884, 1887, and 1888)..... 2.40
ZEITSCHRIFT Rubenzuckerindustrie Stammer (1885-'86, part of 1887)..... 1.20
ZEITSCHRIFT Rubenzuckerindustrie Schublers (Vols. xiv.-xvii. inclusive), complete..... 2.40
Any of the above will be sent postpaid on receipt of price.

SCIENCE BOOK AGENCY,
47 Lafayette Place, New York.

A TEMPORARY BINDER

for *Science* is now ready, and will be mailed postpaid on receipt of 75 cents.



This binder is strong, durable and elegant, has gilt side-title, and allows the opening of the pages perfectly flat. Any number can be taken out or replaced without disturbing the others, and the papers are not mutilated for subsequent permanent binding. Filed in this binder, *Science* is always convenient for reference.

N. D. C. HODGES,
47 Lafayette Place, N. Y.

GEMS AND PRECIOUS STONES OF NORTH AMERICA:

A popular description of their occurrence, value, history, archaeology, and of the collections in which they exist; also a chapter on pearls, and on remarkable foreign gems owned in the United States. By GEORGE FREDERICK KUNZ. Illustrated with eight colored plates and numerous engravings. Price, \$10.

Mr. Kunz, who is well known as an authority upon the subject of gem stones, and who is the expert for Tiffany & Co., possesses peculiar facilities for the preparation of a work of this kind.

Sent postpaid on receipt of price.

N. D. C. HODGES, 47 Lafayette Pl., N. Y.

JUST OUT.

Speech Reading and Articulation Teaching.

By A. MELVILLE BELL.

Price, 25 Cents.

Practical Instructions in the Art of Reading Speech from the Mouth; and in the Art of Teaching Articulation to the Deaf.

[This Work—written at the suggestion of Miss Sarah Fuller, Principal of the Horace Mann School for the Deaf, Boston, Mass—is, so far as known, the first Treatise published on "Speech Reading."]

From *Principals of Institutions for the Deaf*.

"Admirable in its conciseness, clearness and freedom from technicality."
"The simplicity and perfection of this little book."
"Full of exact and helpful observations."
"A very interesting and valuable work."
"The rules are clearly given and will be of great utility."
"Every articulation teacher should study it."
"A model of clearness and simplicity, without having any of the puzzling symbols that trouble the common mind."
"The exercises given in speech-reading from the lips are especially interesting, and of great importance for the student of phonetics."
—*Modern Language Notes*.

* * The above work may be obtained, by order, through any bookseller, or post-free on receipt of price, from

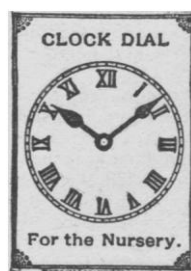
N. D. C. HODGES,
47 Lafayette Place, New York.



DO YOU INTEND TO BUILD?

We offer an Atlas of Sensible Low Cost Houses, a portfolio 11x14 inches, containing handsome illustrations, floor plans, and full descriptions of this popular design, and fifty-four others, ranging in cost from \$800 to \$7,200. This specimen design is for a cottage with seven rooms, and costing \$1,100. It combines beauty and comfort, has two large porches, and is a popular and practical working design, having been built several times for its estimated cost.

No matter what style of a house you may intend to build, it will pay you to have this book.
We will send this Atlas, postpaid, on receipt of price, \$1.—N. D. C. Hodges, 47 Lafayette Place, New York.



THIS DIAL

Consists of a strong cardboard, 5½ by 4 inches, with movable metal hands, and is useful for mothers of infants to record the hour of last nursing, and thus attain regularity in feeding. Serviceable also for teaching time to little children, and as a toy in various plays. Mailed on receipt of 10 cents, by

"BABYHOOD,"
5 Beekman Street, New York.

RUPTURE

cured in stipulated time.

NO DELAY FROM WORK. NO OPERATION.

Call or send stamp for circular and reference of those cured. We have on hand over 300 styles of trusses, from \$1 up, and suspensories of all kinds. Orders filled by mail or express to any part of the United States.

C. A. M. BURNHAM, M.D.,
138 Clinton Place, New York.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the "Want" inserted under this head FREE OF COST, if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.

ARCHITECTURAL DRAUGHTSMAN, of four years' practical experience, wants employment during the four months' summer vacation of the Mass. Institute of Technology. Best of references, including former employer. Address I. M. BARROWS, 50 Union Park, Boston, Mass.

AN OHIO STATE UNIVERSITY graduate desires a position for next year as laboratory assistant or instructor in chemistry and physics. Three years' special preparation for such work. Two years' experience in teaching. References as to character and scholarship. Address C. S. ARNOLD, O. S. U., Columbus, O.

WANTED.—At the BRYANT SUMMER SCHOOL, Roslyn, L. I., THREE professors to teach Sciences, Languages, Mathematics, etc. July 8-Sept. 8. Also, a six months' term beginning now. Other papers please copy. E. HINDS, A.M., Principal.

GRADUATE of Princeton, for several years university student and Fellow in Biology, desires a position either to teach biology or as assistant in a biological laboratory. Would prefer the latter and be satisfied with a moderate salary if the position afforded time for the prosecution of original research. Address, O. S., BOX 86, Princeton, N. J.

THE ADVERTISER—A Third Year Student in Honor Sciences at Toronto University, is willing to take position as Science Teacher or Tutor until next October. Enthusiastic and practical instructor in Biology, Chemistry, Physics, Mineralogy and Geology. Latin and Greek and other branches additional if required. Young, good family. References as to character and ability. CHEMIA, UNIV. COLL., TORONTO.

WANTED—Information concerning the production of Mushrooms in caves and other places. Address M. H. CRUMP, care Ky. Theological Sem'y, Frankfort, Ky.

ASSAYER.—Wanted position as above, has had three years' practical experience in a London firm of assayers to the Bank of England, Royal Mint, etc., etc. Thorough knowledge of bullion assaying, and of gold, silver and lead ores. I. FRED. JOHNSON, Northgate Brewery, Canterbury England.

WANTED—Two first-class Instrument Makers. Apply by letter to T. C. MENDENHALL, Superintendent United States Coast and Geodetic Survey, Washington, D.C.

AN EXPERIENCED Technical Chemist will be open to engagement this summer. Highest references. Address DIRECTOR, Office of SCIENCE.

PROF. WILLIAM FINDLAY, of the Philadelphia Institute of Physical Culture, is open to engagement in summer school to teach Free Movements, Wands, Clubs, Dumb-bells, Fencing and Sparring. Address 1,009 Arch St., Phila., Pa.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 47 Lafayette Place, New York.]

Meteorites.—Mr. George F. Kunz, 11 to 15 Union Square, New York, or Hoboken, N. J., will buy or give in exchange for whole or parts of meteorites. Whole ones, undescribed ones, and entire falls especially desired.

Wanted—To furnish roots of *Dodecatheon Meadia*, *Sarracenia purpurca*, and other wild flowers, native of Southern Wisconsin, in quantities. D. E. Willard, Curator of Museum, Albion Academy, Albion, Wis.

A large number of plants from Maine, Connecticut, Indiana and Illinois for exchange. Southern and western exchanges preferred. Address, enclosing lists, L. N. Johnson, 223 Chicago Ave., Evanston, Ill.

For Exchange—Fourteen volumes *Encyclopedia Britannica* (Stoddard's ninth edition), bound in leather—part in original wrappers, all as new—can arrange to furnish volumes required to complete set, and six volumes "American Naturalist" in numbers. Want small screw-cutting foot lathe and testing galvanometer and rheostat. For particulars address A. B. Campbell, McKean Co., Bradford, Pa.

I have a number of duplicates of microscopic slides, mostly botanical, which I would like to exchange for others not now in my collection. Send list of what you have to exchange and get my list. S. R. Thompson, New Wilmington, Pa.

Correspondence and exchanges solicited with persons interested in the study of American and Mexican antiquities. L. W. Gunkel, 36 Elm St., New Haven, Conn.